Interaction of Iodine and Mercury in Dental Unit Wastewater (10/05)

Stone ME, Kuehne JC, Cohen ME, Talbott JL, Scott JW. Effect of iodine on mercury concentrations in dental-unit wastewater. Dent Mater 2006;22:119–124.

This study was undertaken to determine whether iodine used to control bacteria in dental unit waterlines could increase mercury concentrations in dental wastewater. The study was conducted in four parts. Part 1. Solutions containing iodine in concentrations ranging from zero (control) to 20mg/L were mixed with ground and sieved dental amalgam and then allowed to equilibrate by settling. Cold vapor atomic absorption spectrometry was used to determine mercury levels in the settled supernatants at 24h and at 7 days. Part 2. Deionized water was pumped through an iodine-releasing water-treatment cartridge, collected, and mixed with ground and sieved dental amalgam. Mercury levels in settled supernatants were measured at 24h and at 7 days. Part 3. Iodine in water from two commercial iodine-releasing cartridges was measured using Inductively Couple Plasma Mass Spectrometry. Part 4. Baseline mercury levels in settled supernatants from wastewater collected from two dental chairs were compared to samples taken from chairs equipped with iodine-releasing cartridges. RESULTS: Part 1. A linear correlation between iodine and mercury concentration (r^2=0.9167 and 0.9459, respectively, both P<0.001) was seen at both 24h and 7 days. Part 2. Mean mercury levels in 24h samples were 3.0 times higher than the controls (0.2864mg/L compared with 0.0939mg/L for the 24h controls). Mean mercury levels in the 7-day samples were 5.9 times higher than the 7-day controls (0.2048mg/L compared with 0.0348mg/L for the 7-day controls). Part 3. The effluent from two iodine-releasing cartridges showed iodine concentrations averaging 3.2mg/L (n=10, SD=0.8, range=2.5-4.6). Part 4. Data from the clinical study showed a statistically significant 2.5-fold increase in mercury levels with iodine-containing samples compared to baseline (0.0853mg/L, n=18, SD=0.0441 and 0.0345mg/L, n=18, SD=0.0145, respectively; P<0.001). **The data suggest that iodine can increase concentrations of dissolved mercury in dental unit wastewater.**

DECS Comment: This article addresses two significant topics in dentistry: biofilm in dental unit waterlines and the contamination of dental unit wastewater with mercury. The research was initiated after a dental facility noticed an almost 21-fold increase in dissolved mercury levels in their dental unit wastewater after installing iodine-releasing cartridges to clean their dental unit waterlines. The authors note that although iodine is a good disinfectant and control agent for biofilm, this study demonstrated iodine's ability to mobilize mercury from amalgam particulate in both laboratory and clinically generated wastewater samples. In the clinical phase of the current study, amalgam restorations were both placed and removed; the study did not differentiate between iodine interactions with the mercury in unset, freshly triturated amalgam and that bound in existing amalgam restorations. The authors note that further research is indicated to determine if iodine-containing biofilm-control products affect the wastewater mercury levels in practices that do not use amalgam as a restorative and only remove amalgam restorations. The study also did not address the effect of chloramines used by some municipal water treatment facilities, which could have the potential to interact with amalgam in dental wastewater. Despite these limitations, it was concluded that practices using amalgam as a dental restorative material may want to consider using commercially available biofilm-control products that do not contain halogens to help ensure mercury discharge limits set by local wastewater treatment facilities are not exceeded.